

Pseudoaneurysm of aortocoronary vein graft secondary to late venous rupture: case report and literature review

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Abstract

Formation of pseudoaneurysms of saphenous vein grafts after coronary artery bypass grafting has been reported previously in relation to anastomoses or secondary to infection. Pseudoaneurysm of the saphenous vein graft after late rupture of the saphenous vein and containment by the obliterated pericardial cavity has not been documented. Such a case is reported and published reports of similar cases are reviewed.

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True aneurysmal dilatation of the saphenous vein after myocardial revascularisation is rare and is usually secondary to atherosclerosis.¹⁻⁵

Formation of false aneurysm at the suture lines secondary to infection or technical error has also been reported.⁶⁻¹¹ Late rupture of the body of the saphenous vein graft and containment by the obliterated pericardial cavity leading to the formation of a false aneurysm has not been reported previously. We report such a case presenting 13 years after coronary artery bypass grafting as well as a review of reports of other such cases. The different modes of presentation, possible complications, proposed mechanisms of formation, and management recommendations are discussed.

Case report

A 45 year old man presented in 1977 with angina and was found to have triple vessel and mixed aortic valve disease. He underwent quadruple coronary artery bypass grafting with a reversed saphenous vein, which was noted to be of good quality and calibre at the time. His aortic valve was replaced with a 25 mm Carpentier-Edwards xenograft and the mitral valve was noted to be normal. Three weeks later he developed *Staphylococcus epidermidis* endocarditis which resulted in emergency reoperation for severe aortic regurgitation. The valve had become detached from the non-coronary sinus and it was replaced with a 2.4 cm fresh homograft. Two days after the operation, after a respiratory arrest, the patient underwent emergency tracheostomy and insertion of a left chest drain for pneumothorax. An emergency thoracotomy was also performed for bleeding from the chest drain. Six weeks later he was discharged home afebrile with a normal white cell count.

Ten years later he developed dyspnoea on minimal exertion and cardiac catheterisation confirmed severe aortic regurgitation. All four vein grafts were patent, with some atheroma, but with neither critical stenoses nor aneurysmal dilatation. He underwent aortic valve replacement for perforation of the left coronary cusp of the homograft with a size 9A Starr-Edwards prosthesis.

Three years later, at the age of 58, he once again presented with dyspnoea on exertion and was noted to have severe aortic regurgitation. His chest radiograph showed a small mass overlying the left side of the pulmonary artery (fig 1), which was not evident on chest radiographs for the first year after his previous operation. A computed tomogram confirmed a 3 cm mass on the left side of the pulmonary

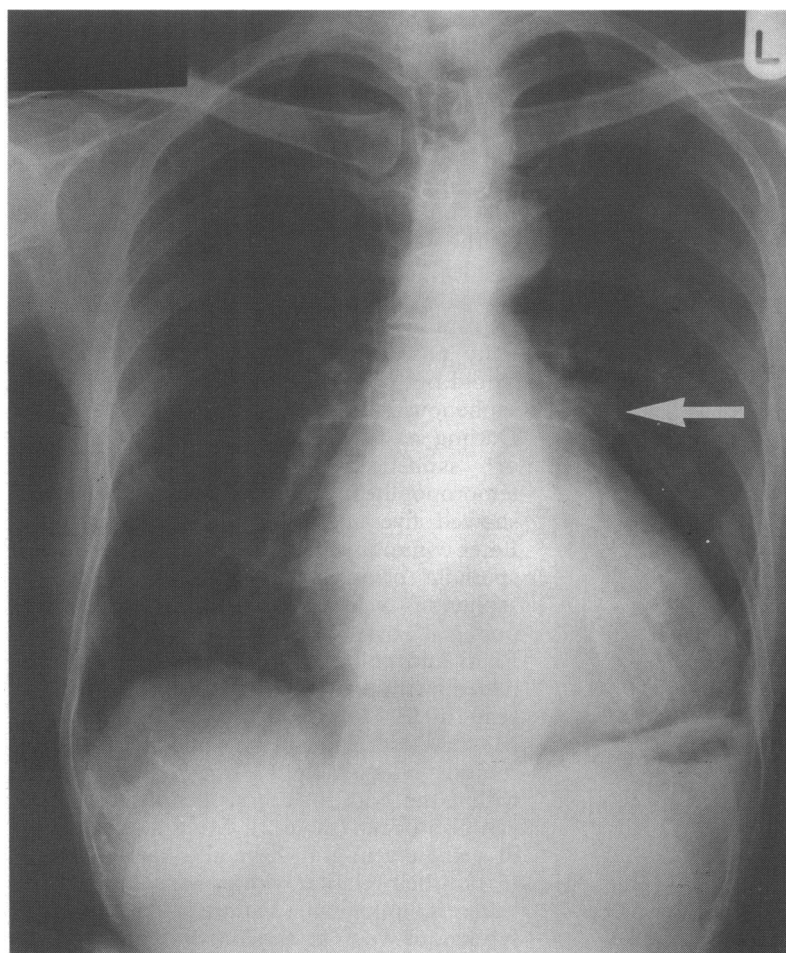
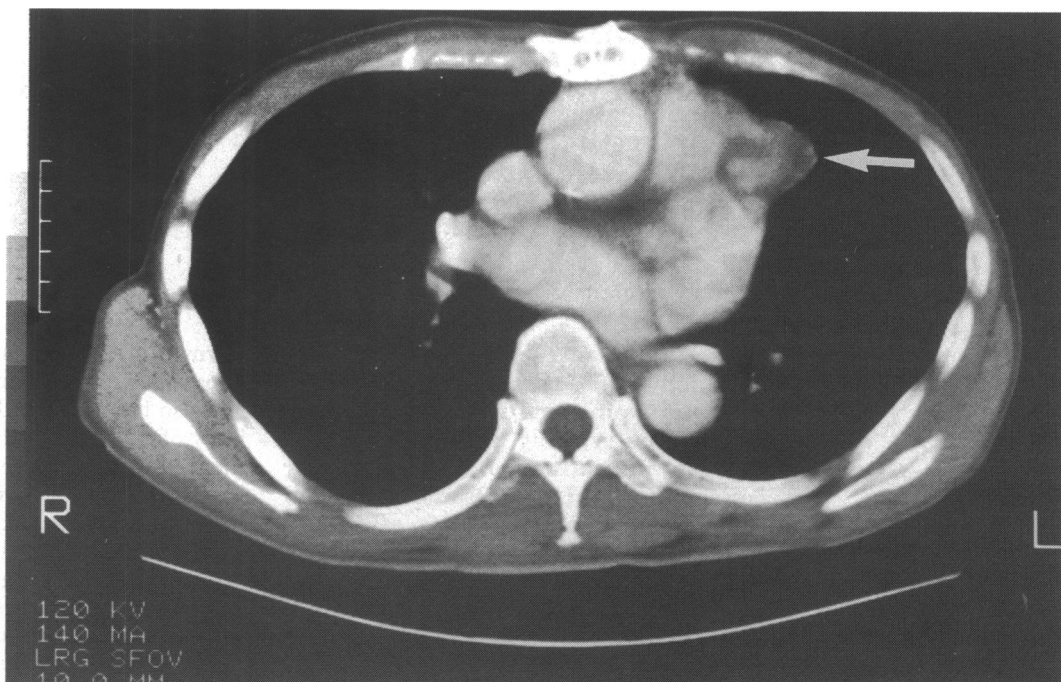


Figure 1 Chest radiograph showing a 3 cm round mass overlying the left side of the main pulmonary artery.

Figure 2 Computed tomogram of the thorax showing a 3 cm mass adjacent to the main pulmonary artery.



artery (fig 2). Cardiac catheterisation showed severe aortic regurgitation and critical stenoses of the vein grafts to the right, the left anterior descending, and diagonal coronary arteries. Angiography of the vein graft to the obtuse marginal branch of the circumflex artery had shown a saccular aneurysm but no critical stenosis (fig 3).

At operation the aortic prosthesis was found to have partially dehiscenced and was replaced with a size 11A Starr-Edwards valve with concomitant triple coronary artery bypass grafts. The aneurysmal part of the vein graft was resected after proximal and distal ligation. After operation he required inotropic support and intra aortic balloon counterpulsation but died 24 hours later from

low cardiac output.

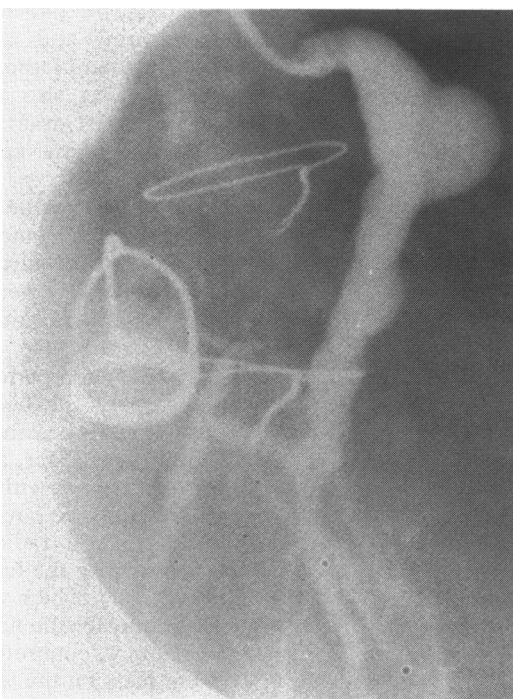
Histopathological examination of the saphenous vein graft showed complete rupture of the intima and media with the ruptured ends folded back (figs 4 and 5). This was contained by the obliterated pericardial cavity and a 2 cm false aneurysm of the body of the saphenous vein graft was formed that contained thrombus. Microscopy of the vein graft at other sites showed some intimal atherosclerosis.

Discussion

In 1968 Dedominico and colleagues¹² reported the development of aneurysms in external jugular veins used in experimental coronary artery bypass grafting in dogs five years after implantation. Despite this finding it was initially postulated that aneurysmal dilatation would not occur in the thicker walled human saphenous veins. This was confirmed by Darling *et al*¹³ in an angiographic study of saphenous veins used for 295 femoropopliteal bypass grafts that only showed five anastomotic pseudoaneurysms. Later communications, however, reported the sporadic occurrence of aneurysms of the saphenous vein after carotid¹⁴ and femoropopliteal bypass surgery.^{15,16} Subsequently Riahi and colleagues first reported aneurysmal dilatation of a coronary saphenous vein graft in 1975¹ although these remain rare. Most are pseudoaneurysms occurring at anastomotic sites (table 1) but true aneurysms within the body of the saphenous vein graft can also occur (table 2). Multiple aneurysms of a single vein graft have also been reported^{3 5 20} but their relation with pre-existing varicose veins is unknown. Failure to reverse the saphenous vein at the time of grafting has been proposed as a possible cause of multiple aneurysms.³

The mechanisms of formation remain

Figure 3 Preoperative coronary angiogram showing a saccular aneurysm of the saphenous vein graft.



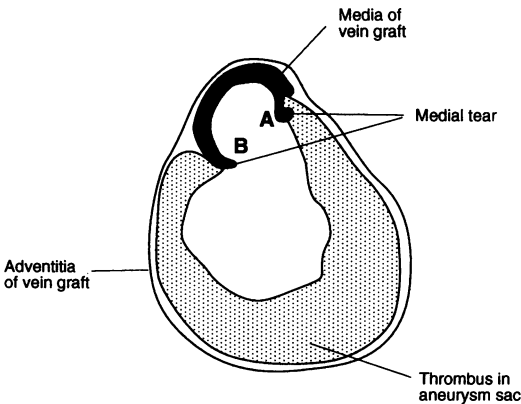


Figure 4 Drawing of a cross section of the aneurysm of the saphenous vein graft showing complete rupture of the intima and media of the vein with the ruptured ends folded back (A and B). The sac of the pseudoaneurysm containing thrombus is also shown.

unclear but the following causative factors have been postulated: hypertension, trauma to the vein at the time of operation, vein necrosis, weakness at a branch site, weakness in the area of valves secondary to absence of circular muscle in the media, coronary steal secondary to a fistula, thrombosis, atherosclerotic change within the graft, mycotic vasculitis, and dissection of the saphenous vein graft (tables 1 and 2). Several factors seem to play a part in the formation of saphenous vein graft aneurysms which may occur as early as 12 days¹⁷ or as late as 17 years after surgery.¹⁶

Figure 5 Microscopical examination of the two ends of the ruptured media (A and B in fig 4). Stained with elastic-van Gieson, magnification originally $\times 40$.

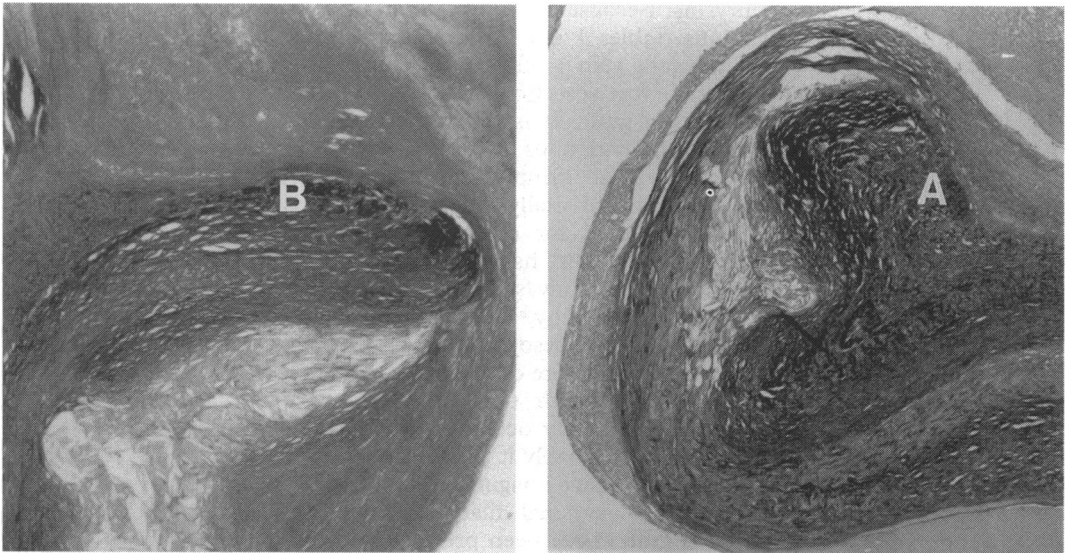


Table 1 False coronary vein graft aneurysms

Authors	Time	Mode of presentation	Management	Outcome	Postulated mechanism
Shapeero <i>et al</i> ⁶	9 yr	Myocardial infarction, mediastinal mass, rupture	Coil occlusion	Survived	—
Yousem <i>et al</i> ⁷	5 yr	Mediastinal mass, rupture	Conservative	Died	Vasculitis
Kazui <i>et al</i> ⁸	2–4 yr	Recurrent angina	Resection and CABG	Survived	Trauma at operation
Sherry <i>et al</i> ⁹	13–15 yr	Recurrent angina	—	—	—
De Haan <i>et al</i> ¹⁰	2 patients	—	—	—	—
Ducksoo <i>et al</i> ¹¹	A few days	Routine early angiogram	Resection and CABG	Survived	Tear of stitches at distal anastomoses
Douglas <i>et al</i> ¹⁷	12 days	Myocardial infarction, mediastinal mass	Coil occlusion	Survived	—
Forster <i>et al</i> ¹⁸	9 yr	Rupture of proximal anastomosis	Emergency reoperation and control of bleeding	Died	Mediastinitis
Smith and Goldstein ¹⁹	17 yr	Large mediastinal mass	Resection	—	—
	2 months	Pulsatile mass over xiphoid	Resection	Survived	Mediastinitis

CABG, coronary artery bypass grafting.

The early aneurysms are more likely to be false and due to infection or operative factors, whereas those of late onset are more likely to be due to atherosclerosis especially in patients with hyperlipidaemia.²⁰

Our case shows a new mechanism of formation of a saphenous vein graft aneurysm. Rupture of the vein graft must have occurred one to three years after the third operation because there was no preoperative angiographic evidence of aneurysmal dilatation. Furthermore serial chest radiographs after operation for the first year did not show the aneurysm overlying the pulmonary artery as shown two years later (figs 1 and 2). Late rupture (11–13 years) of the body of the saphenous vein graft into the pericardial cavity was contained, as a result of adhesions from the previous three operations, leading to formation of a false aneurysm. The fact that the pericardial cavity was obliterated also prevented fatal haemorrhage or cardiac tamponade. The most plausible mechanism of rupture of the saphenous vein graft is weakness of the wall of the vein secondary to atherosclerotic changes.

Saphenous vein graft aneurysms can present in a variety of ways such as a large mediastinal mass^{18,21} or as an enlarging pulsatile mass over the xiphoid.¹⁹ The reported complications include rupture,^{7,22} symptomatic coronary embolisation,²³ fatal dehiscence secondary to bacterial infection,¹⁷ and formation of a fistula between the vein graft and the

Table 2 True coronary vein graft aneurysms

Authors	Time	Mode of presentation	Management	Outcome	Postulated mechanism
Riahi <i>et al</i> ¹	6 months	Aortic regurgitation	Resection and CABG	Survived	—
Pintar <i>et al</i> ²	5–6 yr	Recurrent angina	Resection and CABG	Survived	Atherosclerotic
Benchimol <i>et al</i> ³	2 patients 3 months	Symptom free, multiple	Conservative	Survived	Failure to reverse vein, muscle weakness near valves
Bramlet <i>et al</i> ⁴	5 yr	Unstable angina	Conservative	Died	Dissection of body of SVG, hypertension, trauma, necrosis
Liang <i>et al</i> ⁵	6–10 yr	Recurrent angina, multiple aneurysms	Resection and CABG	—	Atherosclerotic (4)
Teja <i>et al</i> ²⁰	5 patients 14 yr	necropsy, multiple aneurysms	—	Died	dissection of body of SVG (1) Atherosclerotic
Lopez Velardo <i>et al</i> ²¹	15 yr	Large mediastinal mass	Resection	Died	Atherosclerotic
Murphy <i>et al</i> ²²	14 yr	Rupture, large haemothorax	Resection	Survived	—
Talierco <i>et al</i> ²³	9 yr	Symptomatic coronary embolisation	Resection and CABG	Survived	—
Riahi <i>et al</i> ²⁴	10 yr	Fistula between SVG and RV	Resection, CABG, and closure of fistula	Died	Atherosclerotic
Dzavic <i>et al</i> ²⁵	13 yr	Myocardial infarction	Conservative	Died	—

CABG, coronary artery bypass grafting; RV, right ventricle; SVG, saphenous vein graft.

right ventricle.²⁴

As most aneurysms of saphenous vein grafts remain undiscovered their true incidence and natural time course are likely to remain unknown. As a result it is difficult to formulate rigid management policies for this pathology but some guidelines can be put forward in the light of reported cases. In the presence of another cardiac pathology requiring surgical intervention the aneurysm should be resected at the same time even if there is no restriction to flow in the vein graft involved. Although successful coil occlusion treatment for controlling haemorrhage from an aneurysm of the saphenous vein graft has been reported,^{6,11} surgery remains the treatment of choice for the complicated aneurysms. Because of the likelihood of complications (tables 1 and 2) a large aneurysm with a patent vein graft should probably be considered for resection and replacement with another graft. It is difficult to propose clear recommendations regarding the management of small symptom free aneurysms discovered coincidentally, but they should at least be observed for changes in size and complications. This has been successfully performed by non-invasive methods such as computed tomography,⁶⁷ magnetic resonance imaging,⁹ and transoesophageal echocardiography.²⁵ It is even more difficult to know what should be done with the aneurysmal vein graft that has already occluded distal to the aneurysm, but probably it should be followed up with non-invasive imaging.

Although aneurysmal dilatations of saphenous vein grafts have been previously reported this is, to our knowledge, the first reported case of false aneurysm formation after late rupture of the body of the vein graft.

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